European Geologist, June 2005, 24-26

New geoscience surveys in Northern Ireland

EurGeol Mike Young and Dr Dermot Smyth
Geological Survey of Northern Ireland, Belfast

Summary
New regional geochemical and geophysical surveys are in progress in Northern Ireland. These will advance the development of the natural resource industry and provide a baseline of information against which to measure environmental change. Soils, stream-sediments and stream-waters are being sampled, according to the G-BASE standard of the British Geological Survey, and analysed by XRF and ICP. The airborne geophysical survey will be flown by a fixed-wing aircraft equipped with magnetometer, 256-channel gamma-ray spectrometer, and electromagnetic systems. The line spacing will be 200m and ground clearance 55-90m over rural areas and 250m over urban districts.

Geological mapping, mineral exploration and environmental monitoring in Northern Ireland will all benefit from a new initiative, the Tellus Project, funded by the Department of Enterprise, Trade and Investment (DETI). The project, managed by the Geological Survey of Northern Ireland (GSNI), comprises comprehensive regional geochemical and airborne geophysical surveys of the whole land area of the country.

The goals of the project are:

- To advance the development of Northern Ireland's natural resource industry through new discoveries and provide the basic geological data and framework for decision-making and development planning;
- To provide a baseline of information against which to measure future environmental change;
- To contribute to sustainable land-use planning decisions by detecting and mapping geological conditions that may be associated with natural hazards and land drainage;
- To detect and map certain forms of industrial and agricultural contamination and the conditions under which these might develop;
- To help government to comply with the requirements of legislation on the assessment and monitoring of natural resources, soils and waters, including European Framework Directives.

The Tellus geochemical survey began in the summer of 2004. This is a multi-media survey of soil, stream-sediment and stream-water samples in rural and urban areas. The survey is not constrained to the rural environment and all areas from the centre of Belfast to the remote peaks of the Mourne Mountains will be sampled. Tellus will establish the natural geochemical baseline signature and any anthropogenic overprint, providing data applicable to mineral exploration and geological mapping, pollution delineation and monitoring. Soils and stream sediments are sampled at approximately one site per 2 km^2. Soil samples are taken from two depths (20cm and 50cm) at each site to provide an insight into vertical geochemical variations. Urban soils will be sampled at a distribution of four sites per km^2 and will be analysed for inorganic and organic compounds.

Soil and stream sediment samples will be analysed for more than 50 elements by XRF and ICP-MS/ AES, and for platinum group elements by lead fire-assay. Soils will also be analysed by aqua regia digest ICP-MS to provide a dataset relevant to the minerals industry and for environmental assessment. Waters will be analysed by ICP-MS and ion chromatography.

Previous regional geochemical surveys have included a reconnaissance survey of stream sediments by Imperial College, London, in 1969-73; later surveys by the Geological Survey of Northern Ireland; and a nationwide survey of lowland agricultural areas by the Department Agriculture and Rural Development. The current work will complete the national survey of stream sediment and water sampling begun in 1994 by the British Geological Survey (BGS) on behalf of the Department of Economic Development and Department of Environment. The survey follows the British Geological Survey's Geochemical Baseline Survey of the Environment (G-BASE) standard developed over many years and applied to map the regional geochemistry of the United Kingdom. For Tellus the GBASE specification will be enhanced by additional analyses and elements, including Au, Pd and Pt.

The Tellus airborne survey will be completed over two seasons in 2005 and 2006. The survey will be flown by the Joint Airborne-geoscience Capability, a newly formed partnership of the BGS and the Geological Survey of Finland (GTK). The survey will be flown with a De Havilland Twin Otter aircraft used previously for geophysical surveys in Finland and elsewhere and purchased in 2004 by the Natural Environment Research Council. The aircraft is equipped with two magnetometer sensors, 256-channel gamma-ray spectrometer, four-frequency electromagnetic system, laser altimeter and GPS navigation system. The line spacing will be 200m and ground clearance 55-90m over rural areas and 250m over urban districts. Data will be processed by GTK and BGS and interpretation will be undertaken by GSNI in Belfast.

The last regional geophysical survey of Northern Ireland was a total-field aeromagnetic survey flown at 2km line spacing for BGS in 1959-60. The magnetic anomaly maps revealed regional and local faults and fractures, and delineated prominent magnetic lithologies. The new magnetic survey, flown in gradiometer mode at one tenth of the line spacing and at low altitude, will resolve more detailed magnetic textures, which will assist structural and lithological mapping, particularly of areas covered in glacial materials. The radiometrics will further support geological and soils mapping and provide a detailed base-line on natural and artificial radionuclide distribution. The four-channel EM system will map variations in electrical conductivity in the upper 30m and contribute to both mineral exploration and environmental mapping.

The results will be interpreted in relation to pre-existing geological, topographical and land use datasets. Data will be made available under licence to academic and commercial users. Existing data are already licensed to mining companies and the project is expected to promote further mineral exploration. 2003 and 2004 saw a substantial increase in mineral exploration licensing in Northern Ireland and the area under licence or application is now at its highest level since 1991. Two companies have made significant steps towards commercial gold production and others are actively pursuing exploration programmes.

The survey will establish baseline geochemical and physical characteristics of soils and streams and provide a context for evaluating environmental change. Mapping vital trace elements in agricultural soils and surface waters and measuring levels of natural and artificial contaminants in agricultural and urban areas will contribute significantly to land-use planning.

The airborne EM and radiometric surveys will also contribute to mapping certain classes of ground conditions, notably ground and groundwater salinity, acid drainage from old mine sites and radon susceptibility.

A substantial programme of public information is underway to raise public awareness of Tellus and its value for planning and development. In addition to presentations to government departments, local councils and environmental organisations, several innovative events and initiatives have generated a wider interest in geology and the environment in schools and colleges throughout Northern Ireland.

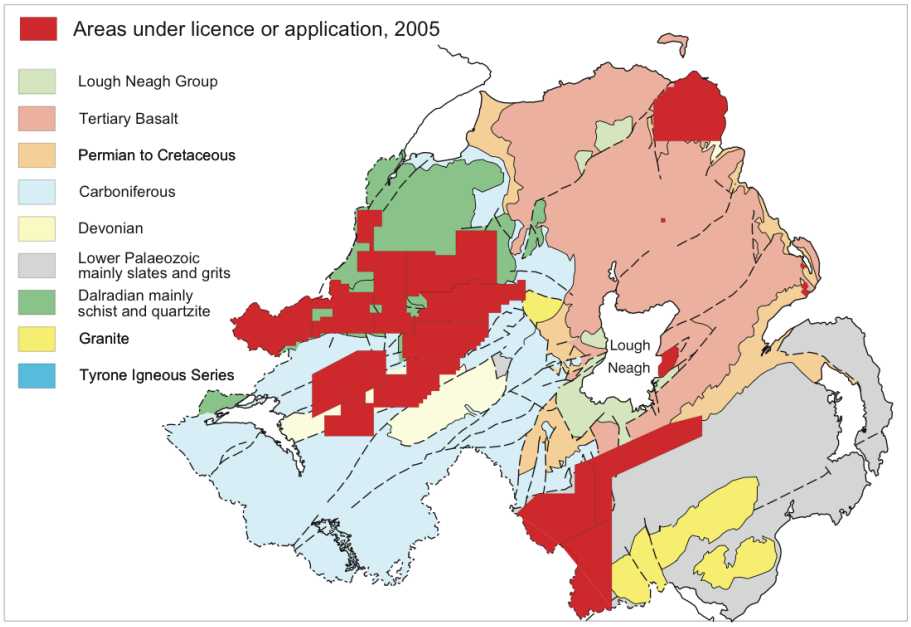

Figure 1. Geology of Northern Ireland, showing the areas licensed for mineral exploration © Crown Copyright

Figure 2. Soil sampling survey © Crown Copyright

Figure 3. Twin Otter geophysical aircraft.